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ABSTRACT

The influences of computer technology on college nursing education programs and health care delivery systems are discussed in eight papers. The use of computers is considered, with attention to clinical care, nursing education and continuing education, administration, and research. Attention is also directed to basic computer terminology, computer system design, sources of information on computers, and system costs. Functions of a medical information system are discussed, along with a specific application of computers: the Nursing Education Module Authoring System (NEMAS), which can be used to create instructional modules and to deliver the modules to learners and record their responses. Titles and authors of the papers are as follows: "Computers in Nursing: Where Are the Leaders?" (Richard E. Pogue); "Basics of Computer Technology: Clearing the Crystal Ball" (Gary D. Hales); "Dean's Use of Computer Technology in Administering a Nursing Program" (Billye J. Brown); "Computer-Assisted Instruction in Nursing Education" (Donna E. Larson); "Computer Use in Nursing Service" (Carol A. Romano); "Nursing Education Module Authoring System" (Carole Hudgings); "Drug Therapy Course" (Lucille M. Pogue); and "Survey of Microcomputer Use in Southern Nursing Education" (Audrey F. Spector). (SW)

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COMPUTER TECHNOLOGY AND NURSING EDUCATION

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Southern Council on Collegiate Education for Nursing

COMPUTER TECHNOLOGY AND NURSING EDUCATION

Southern Council on Collegiate Education for Nursing
1340 Spring Street, N. W.
Atlanta, Georgia 30309
1984
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The Southern Council on Collegiate Education for Nursing (SCCEN), founded in 1962, is a membership organization made up of deans and directors of associate degree, baccalaureate, graduate, and continuing education programs for nurses in more than 200 colleges and universities in 14 Southern states.

The Council provides a forum for sharing information and promoting communication among all types of collegiate nursing education programs, conducts studies and publishes reports, plans and conducts regional activities to stimulate research in nursing in higher education, and engages in many other activities all designed to strengthen nursing and nursing education in the South.

SCCEN is affiliated with the Southern Regional Education Board (SREB). The 14 member states are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

COMPUTER TECHNOLOGY AND NURSING EDUCATION

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FOREWORD

Since its formation in 1962, the Southern Council on Collegiate Education for Nursing, in affiliation with the Southern Regional Education Board, has addressed a variety of issues and needs in nursing education. Some of the regional activities have stemmed from developments in higher education in general; for example, an increasingly diverse student population on college campuses prompted regional action to promote new and varied teaching strategies in the college-based nursing programs. Other activities have been in response to trends in the health care delivery system and the need to prepare nurses with knowledge and skills to meet the changing demands of the work place.

Now, new challenges are posed to the college-based nursing education programs by the phenomenal growth in computer technology and the rapid changes surrounding its use both on college campuses and in the health care delivery system. It is predicted that there will be 20 times as many microcomputers in use on the nation's college campuses in 1985 as there were in 1980. As computer technology becomes more affordable, almost all college campuses are expanding its use for research and administration, and its use as an instructional tool is underway or is being planned. In this climate, college-based nurse educators are keenly interested in applying the newly available technology in nursing programs. At the same time, nursing schools are pressed to prepare graduates who can function in an increasingly automated health care delivery system. It is predicted, for example, that in the next three to five years utilization of computer technology in hospitals will increase by about 60 percent and that 70 to 80 percent of all hospital functions will be computerized.

A 1983 survey of collegiate schools of nursing in the South documented the concerns, needs, and high level of interest among nurse educators regarding computer technology. Accordingly, the 1983 annual meeting of the Southern Council on Collegiate Education for Nursing, held in Atlanta, October 26-28, 1983, addressed the nurse administrators' needs--including the basics of computer use and application in the health care system and for instructional purposes. This publication includes papers based on presentations at the meeting, descriptions of instructional programs that were demonstrated, and a report of the regional survey.

Audrey F. Spector
Executive Director
Southern Council on Collegiate
Education for Nursing

COMPUTER TECHNOLOGY IN NURSING: WHERE ARE THE LEADERS?

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INTRODUCTION

> Soon a college graduate with no facility in communicating with computers will be almost as handicapped in dealing with the challenges of society as a functional illiterate is now.

This is not a statement by some far-out computer expert enamored with technology. Rather, this statement was made by Vernon Crawford, chancellor of the University System of Georgia, in his 1983-84 budget request to the Georgia legislature for quality improvement funds to increase access to computer facilities by University System faculty and students. Moreover, he added:

> Many of our faculty members will soon be dealing with students who have had several years of experience in working at one level or another with computers. AN INSTRUCTOR WHO IS LESS SKILLED THAN HIS STUDENTS IN THIS IMPORTANT AREA WILL BE AT A PSYCHOLOGICAL AS WELL AS AT A FUNCTIONAL DISADVANTAGE. (Emphasis added.)

Let's approach our topic in another way--through scenarios which illustrate uses of computer technology within nursing.

SCENARIOS ILLUSTRATING COMPUTER USE

A. Clinical Care

On a clinical unit, a nurse turns to the computer to get the care plan for a new patient just assigned to the unit. She reviews the care plan on the screen, notes that

it has been changed slightly since yesterday, asks for explanations of components which she doesn't understand, and then prints a copy of the care plan.

As she leaves to go to the patient, another nurse uses the computer to carry out computations of drug dosages for several patients, and prints the dosages to take along with her. She decides to return later to take a lesson that reviews a category of drugs which she hasn't used for a while.

B. Nursing Education

A group of undergraduate nursing students enrolled in a self-study pharmacology course enter the learning resources laboratory to take the next computer-based lesson in the sequence. They review certain disease entities, learn about the drugs commonly used in managing these diseases, practice computing dosages for these drugs, and then practice making clinical decisions in simulated situations where these drugs are used.

At the end of the lesson, the computer shows each nurse how well he or she performed on the lesson. Two of the students are advised that they are weak on a couple of the topics covered, are directed to remedial study materials, and advised to go through the lesson again. The others remain at the computer to take the evaluation test which provides confirmation of their competency on this topic.

C. Nursing Administration

A nursing supervisor is reviewing the staffing schedule prepared by the computer for the units for which she is responsible during this shift. She concludes that two units need additional staff, and decides to pull them from another unit. She enters this information into the computer and gets a revised staffing schedule. However, this leaves her short one nurse, so she calls up a computer file of nurses available for extra duty. She points to the name of a nurse on the screen, and the computer automatically dials the telephone number of that nurse. The supervisor picks up the phone beside the computer, tells the nurse her problem, and the nurse agrees to come in immediately.

D. Nursing Research

A clinical nurse specialist decides to do research on a clinical problem in her specialty. Knowing that her hospital has all its clinical patient records on the computer, she poses her research problem, identifies the patient data needed to answer her research question, and selects the appropriate statistical analysis. She enters her request for data into the hospital computer, which provides her with a data file that is coded to protect the privacy of the patients selected for her study. She realizes that the size of the data base is too large to be analyzed on the hospital computer, and forwards it for analysis on the large research computer in the state. Within a few hours of her request for data from the hospital computer, the results of the statistical analysis are printed out on her personal printer.

E. Continuing Nursing Education

In the staff development department, a group of new nursing employees have just finished taking the test on drugs required by the hospital. One has passed all components of the test; the remainder have not met the requirements for several different categories of drugs. Those who have failed some parts of the test take lessons on the computer to review these categories. Several decide to take lessons on categories that they passed, but in which they feel unsure of their knowledge. All nurses in the group successfully pass the test by the end of orientation and are certified to administer drugs on their units.

They also note that lessons are available on topics for which they may receive continuing education credit. All of them decide to return for lessons of particular relevance to their professional interests, thus helping them meet the continuing education requirements of the profession and increasing their value to the hospital as well.

These scenarios are real, and are being played out somewhere today.

A SCENARIO FOR THE FUTURE

Finally, let's consider a scenario for the future, posed in a book written by a physician, J. S. Maxmen, and titled, *The Post-Physician Era*. The thesis of Maxmen's

book is that computers will eventually make most of the technical diagnostic and treatment decisions currently made by the physician. Moreover, a new kind of health professional will fill the physician's current role in the delivery of front-line health care and will perform other technical tasks. These new health professionals would require less formal training than the physician of today, and would be selected for their humanistic characteristics rather than their scientific intellectual capabilities. Imagine, a restructuring of health care delivery in which the role of today's dominant player would be drastically modified!

I ask you: Is not the nurse practitioner of today the logical candidate for this role of tomorrow?

And now to the theme of my presentation.

Where are the leaders within nursing with the vision--and courage--to pursue the technological challenges facing nursing today, and to prepare for this world of tomorrow?

Where are the leaders in positions of responsibility who will accept Chancellor Crawford's mandate, and will lead their profession into a world that relies heavily on computers and communications technology?

Where are the leaders within nursing with the technical expertise and understanding to provide technical direction and support?

That is the challenge which all health professions face today. And it is my contention that the challenge is perhaps more significant--and offers more opportunity--to nursing than to any other health profession.

EVENTS IN SOCIETY

To understand the reasons for Chancellor Crawford's statements and the challenge of the new technologies to the health professions, it is helpful to look at what is happening in society as a whole. The technological developments occurring in

society are a driving force to which the health professions are being forced to respond. Fortunately, they are a force which, with wisdom and leadership, can be used to better the health of our people and the well-being of the health professions.

One can make a strong case for the argument that technology is a major factor in determining what a society is or may become. As a few examples, a primary difference between the "have" and "have not" nations of the world is the difference in their technological development. The printing press provided the technological basis that made education of the masses possible. The industrial revolution provided the technological basis for changing societies from rural, agrarian forms of organization to our modern urbanized, industrialized societies. And, although we in academia may not often stop to think about it, the invention of new technologies has been a major force behind the growing need to educate every citizen to function effectively within society.

Those who study such things contend that the computer will have more impact on the history of mankind than did the industrial revolution. This case is particularly well made by Christopher Evans in his book, *The Micro Millenium*. Evans describes the characteristics of the industrial revolution as follows: One, it amplified man's muscle power, permitting us to carry out physical accomplishments never before possible. Two, it brought about tremendous changes in society, including the way we organize and live. Three, it happened very rapidly, in a space of less than 150 years. Fourth, once started, its growth was unstoppable, even remorseless in its impact. And fifth, and particularly interesting, no one really foresaw its total impact on society, so that society was surprised--and unprepared--when it happened.

Evans compares the computer revolution with the industrial revolution in its total impact on society but sees some important differences. The biggest, of course, is that the computer revolution is aimed at amplifying our intellectual and knowledge processes. Another, perhaps somewhat frightening, difference is that the computer revolution will take place in far less time, perhaps in as few as 50 years. (The history of the electronic digital computer as we know it goes back less than 40 years.) Finally, and a most hopeful factor, is that our modern communications allow

us to observe and predict what's likely to happen, therefore giving us time to prepare for the anticipated changes

Why is the computer having such an impact on society? The answer may take many forms, depending on your perspective, but my view is that the computer brings together into a single device four major threads of technological development through human history.

One thread has been the development of computational machines to help calculate increasingly complex numerical problems. In fact, this was the major motivation for developing the first electronic digital computer.

Second has been the creation of devices for storing, organizing, and retrieving the vast amounts of information being generated at an increasingly rapid rate by modern societies.

Third has been the efforts to develop mechanisms for communicating with each other across distances. The drums of the jungle and the smoke signals of the prairies are indeed primitive when compared with the telephone, telegraph, radio, and television.

The final thread has been the development of intelligent machines to assist in making the increasingly difficult decisions that must be based on both a complex environment and large masses of information to be productive.

In the computer, the genius of man has developed a single device which combines all of these capabilities into small, inexpensive, readily accessible, and easy-to-use devices available to us all.

You might logically ask at this point: If computers really have all of these capabilities, why haven't we made more progress in using them in the ways people envision? The answer lies in the perspective of time. The first electronic digital computer was invented less than 40 years ago, and began making its way into society

only 30 years ago. Computers have been widely used in business for about 25 years, but were introduced to education and patient care only about 20 years ago. And, they remained under the control of the "high priests of computing" until the late 1970s when the microcomputer "revolution within a revolution" began.

From another perspective, the 1950s were a time of one machine/one user. In the 1960s, we learned how to allow many users to share one machine. The 1970s were the decade in which we learned how to make computers talk to one another and to provide access across broad geographical areas. In the 1980s, we are now back to the time of one computer/one user, except that each of us now has a computer with the ability to communicate with a wide variety of computers--and each other--over long distances.

Never in the history of mankind has such a powerful technological device had such a tremendous impact on society within such a brief period of time. And therein lies the problem: we have simply not had enough time to learn how to use--and adapt to--the computer. This is certainly true for the complex and fragmented health care system that exists in this nation and elsewhere.

An anecdote may help put the rapidity of progress in perspective. If the automobile industry had accomplished what the computer industry has over the last 30 years, a Rolls Royce would cost $2.50, would get 2 million miles per gallon, would have power enough to drive the Queen Elizabeth II, and six Rolls Royces would fit on the head of a pin. At $2.50 each, I guess even those of us in academia could afford the luxury of a Rolls.

To confirm that the technological challenge exists in your world of today, you need only read the popular press, watch television, or read the professional literature and attend professional conferences to realize that the computer revolution is upon us now.

Supporting this nonscientific evidence is the fascinating book, *Megatrends*, by John Naisbitt. Naisbitt identifies 10 major trends impacting society today, trends

which he expects to continue through the next few decades. Two of them are particularly important to our discussion. One confirms that we are indeed moving from an industrial society to an information society. The other, and perhaps more surprising, is a trend which he calls "high tech/high touch." As a compensation for the increasing use of high technology, mechanisms for providing greater human interaction will be necessary. In other words, the more high tech, the greater the need for high touch. This offers significant hope that we will be able to meet our needs for human interaction in the midst of a high technology world--certainly a matter of great concern to all involved in health care, both providers and users. Interestingly, he used several examples from nursing to illustrate his point.

Within the health professions, work being done in the field called "artificial intelligence" is already demonstrating that the computer can be used to develop "expert systems" to support medical decision making. Perhaps of more significance in the short run may be recent work of Dr. Larry Weed in developing "problem-knowledge coupling" systems on microcomputers. Weed uses the computer to record information about a patient's problems, and couples it to existing knowledge about the causes of and treatments for the patient's complaints. The value of the computer in this role is that it can collate and relate far more information, far more rapidly, than the human mind can possibly handle reliably and consistently.

One unexpected result of such work may be to put medical and nursing diagnosis on a scientific foundation. Such a possibility must certainly be very threatening to those who believe that the art of diagnosis represents the highest expression of their professional abilities. Should this happen, however, it will simply parallel other intellectual efforts which were, of necessity, practiced as an art form until an underlying rationale was developed and taught to its practitioners.

Does this mean that the computer will "do it all," and that the health professional will become a passive participant in key aspects of health care? Possibly, I suppose, but I have faith that mankind's ingenuity will be up to the task of defining a role for our technology that will be supportive of what will always remain essentially a human activity. In fact, as noted in the trend toward high touch, the

humanistic role of the caring health professional will be even more important as we increase our use of technology in health care.

HOW DO WE DEVELOP OUR LEADERS IN NURSING?

First, let me say that there are nurses who are leaders in the use of computer technology within nursing. My perception, and therefore my concern, is that these leaders are too few in number, and that they have arrived at positions of leadership because of a personal interest in computing. While this is perhaps natural--and is definitely all to the good--we have yet to see many schools or departments of nursing that have decided to provide leadership in the use of computer technology as an organizational objective. It is my contention that this must happen if the nursing profession as a whole is to deal effectively with computer technology.

Let's consider the problem of developing leaders in the use of computers in nursing. First, you should be aware that there is no commonly accepted definition of what it means to be computer literate--in the health professions or elsewhere. Two sessions at the 1983 second annual fall conference of the American Association for Medical Systems and Informatics (AAMSI) dealt specifically with this question. The ideas on the subject were diverse and in many instances contradictory.

A major debate is whether health professionals should have to learn to program the computer in order to become computer literate. I think not, and both the service and academic programs at our institution are based on this premise. What is required, however, is that all health professionals be expert in algorithmic thinking--the process of identifying and specifying the steps in instructing the computer on how to carry out a sequence of actions. Essentially, this requires nothing more than the ability to think logically and work systematically in solving a problem. You need only learn how to apply abilities you already have to an environment which uses computer technology.

After all the discussion on computer literacy at the AAMSI conference, the clearest definition of computer literacy I heard was made after the session by my wife, who said, "To me, computer literacy is what I need to know in order to do what I want to do with computers as a practicing nurse." Succinct, and accurate.

At the same sessions, Dr. Harold Schoolman, currently acting director of the National Library of Medicine, differentiated between two aspects of computer literacy: the acceptance and use of the computer as a computational tool, and its use as an intellectual tool for human decision making and other intellectual activities. (He also expressed his belief that the computer will eventually alter medical education as we know it today.) The first level of computer literacy will be more easily accomplished because it requires only the application of intellectual capabilities possessed by all health professionals. The level of learning how to use the computer as a tool of our intellects will be much more difficult because it requires a change of perceptions of the practice of medicine, and of the roles which health professionals play in health care. Thus, a change in fundamental attitudes is essential.

I believe that Dr. Schoolman's perception goes to the heart of the problem of computer literacy in all health professions, and also offers the basis for a solution. Let us begin by learning to use the computer in our everyday professional lives--for word processing, record-keeping, and other familiar activities. Only after developing a basic understanding of the tool that comes with that process, can we begin to conceptualize about ways to use the computer in how we think about and practice our professions.

A further approach which we have found useful in organizing the program for computer literacy training at my institution is to define three levels of computer literacy: attitudinal, application, and technical computer skills.

At the attitudinal level, we offer courses, seminars, and general workshops in which the objective is to develop general awareness of the role of computers in the health professions, familiarity with general concepts and terminology, and comfort in using the computer for various purposes.

At the application level, we offer courses and intensive workshops on a specific use of the computer, for example, word processing, computer-assisted instruction, health information systems, etc., so that faculty learn specific skills at a further level of depth and detail.

Our only offering at the technical skill level currently involves a computer programming course, which we advise nurses and other health professionals not to take. However, we have in the approval process a master's degree proposal which will offer add-on degrees in computing for health professionals who wish to specialize in the use of computer technology within their profession. The graduates of this program would be uniquely equipped to provide both technical and intellectual leadership on the use of the computer within their health profession.

A major barrier to the impact of our program is that all courses are electives, and faculty attendance is an individual matter rather than a school or departmental matter. Thus, progress in computer literacy is slow and fragmented, and to date has had relatively limited impact on a school or departmental basis. If nursing is to meet the challenges outlined earlier, such training must be undertaken as a school or departmental objective, at the instigation, and with the support, of the dean or director.

Resources must be committed, release time given to faculty, and a reward system established that recognizes new expertise through salary increments, promotions, and tenure decisions. Experience has amply demonstrated the difficulty in attempting to add a new area of expertise as an add-on to other responsibilities. Many faculty have attempted to do this, but are able to sustain the level of effort and time commitment for only a short period of time before they begin to suffer the classic symptoms of burn-out, and finally decide that their personal and professional survival requires that they give up their computing activities and return to more classical professional activities. That's a guaranteed road to failure, regardless of the profession. Computer literacy programs must be put on a programmatic, rather than a personal, basis if they are to succeed over the long haul.

As far as educating our nursing students in computing is concerned, I believe that the best way is in the context of courses in nursing. This approach places computer technology in the role of a routine tool of the nursing profession, and provides students with role models of nurses making effective use of the computer in nursing practice. It should also make it easier to incorporate computer training into the

already crowded curricula. The current difficulty, of course, is that few nurses have the computer knowledge to serve in the required teaching roles. Thus, in the short term while nursing faculties are undergoing the necessary training, we will undoubtedly have to rely on separate courses, taught more often than not by computer professionals.

The long-term solution lies in training our nursing faculties in computer technology. The proposal of the Southern Council on Collegiate Education for Nursing to provide decentralized workshops in computer technology for nurses throughout the Southern region is an excellent step in this direction, and I wish to compliment the Council for the vision and foresight which this proposal represents. The program proposal seems to fit well into the model outlined earlier, in which the first stage would be to train faculty in general computer concepts and applications in nursing, with liberal amounts of hands-on computer experience so the attendees develop the facility to use the computer in particular applications after the workshop. From personal observation, I would expect that these faculty would in turn serve as catalysts in training their colleagues, facilitating cooperation and collegiality among faculty in dealing with the computer world.

The second phase might then be to train these faculty to become experts in specific uses of the computer of particular personal interest, whether it be record management, research, or instructional uses of the computer. At least some of them should then opt for add-on degrees in computing, particularly if the means were made available for providing sabbatical time and financial support. Upon completion of such programs, the graduates would then be able to serve as the local computer experts within nursing schools and departments, and would be prepared to provide technological leadership within the nursing profession as a whole.

WHERE ARE THE LEADERS IN THE USE OF COMPUTERS IN NURSING?

Let me close by returning to the main theme of this presentation, but rephrasing the title to ask: Who <u>should</u> be the leaders in computer technology in nursing?

First, every nurse must be a leader in the integration of computers into the nursing profession, for only nurses can--and should--determine the role of computer

technology in nursing. This does not mean that every nurse must be an expert in computing. Rather, each nurse must understand and be able to use the computer effectively in her or his role within the nursing profession.

You--the nursing deans and directors--are the leaders with the ability and responsibility for conceptualizing the role of computers within nursing as a profession, and for preparing nurses to function effectively in their use of computer technology. You are the leaders who must foresee what is coming, so that you may direct nursing along a path that will benefit society and the profession of nursing. You are the leaders who must be convinced that computer literacy is a mandate for your faculty and for your students, a mandate which must be incorporated into your curricula. You are the leaders who will determine nursing's role in the computerized health care world that is upon us.

My key note to you is for action--action which will make nurses, not someone else, the experts on the appropriate use of computers within the nursing profession.

Would you not rather direct your destiny, than allow others within or outside of the health professions to shape it for you? Nursing is at the heart of the health care system and it, more than any other profession, will feel the impact of the new technologies. To a great extent, it will be the nursing profession who will decide how humanistically computers will be used for the well-being of our people. Surely, nursing is the key humanizing and integrating force within the entire health care system.

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BASICS OF COMPUTER TECHNOLOGY: CLEARING THE CRYSTAL BALL

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BASIC COMPUTER TERMINOLOGY

CPU This is the central processing unit or "brain" of the computer which directs the computer's operations. There are various kinds of CPUs in use designated by numbers, such as 8080, 8088, 6502, etc. The important thing to know is that the CPU (or microprocessor) in the computer dictates the type of software that can be used on that computer. You cannot, for example, run CP/M software on an Apple IIe which has a 6502 CPU unless you add a Z-80 CPU.

Memory The computer system has storage areas for data and instructions. The greater the storage available, the longer, and often more complex, the program can be. In addition, large amounts of computer memory allow manipulation of large amounts of data. Computer memory is described by the number of Kilobytes, or thousands of characters, which can be stored. A 64K memory can store just around 64,000 characters--number, letters, symbols. A major dictum of computer use is that you cannot have too much memory.

Peripherals This category contains all those devices that are literally peripheral to the actual operation and use of the computer. That is, the computer can function without the peripheral, but you will not be able to use the product of the computer's labor. Peripherals include:

Author's Note: This outline was developed from a verbal presentation made to the Southern Council on Collegiate Education for Nursing.

Monitors Video displays are used to view your input to the computer and to see the output from the data processing. Most displays use cathode ray tubes (CRTs), but the newest technology is the flat screen display seen on many portable computers. For educational use, color monitors are preferred since color can be used to convey concepts not possible with monochrome monitors.

Storage mediums You must have some kind of unit used to store information when the computer is turned off. The most common storage devices are:

Tapes With tape one can store large amounts of information, but the access is sequential. That is, the tape must be physically moved to the location of the information to permit reading; this is slower than disk access.

Disks With a disk and the accompanying drive, there is relatively immediate access to any point on the disk. The disk, which looks something like a record, spins, and the drive positions a read/write head over the section to be used to store data on the disk or to read data which has been stored. Floppy disk drives are commonly used in microcomputers--the name deriving from the flexibility of the disk used--and have storage capacities of up to 1 megabyte. Hard disk drives use rigid disks which spin at a much faster rate, resulting in much faster storage or retrieval, and have storage capacities of 5 megabtyes (5 million characters) and up. Tape drives of some kind are often used to "back-up" (make a copy of) hard disks due to the large amounts of material stored.

Printers Often one needs a printed or "hard" copy of the information that appears on the screen. The two most common types of printers are:

Dot matrix The letters are made by the formation of a series of tiny dots on the paper. This quality of print is acceptable for internal use but "correspondence quality" print is desired for external communication. Some of the newer dot matrix printers have this quality of print, which produces darker, more complete lettering by overprinting the characters.

Letter quality The printer uses an "element" similar to that used on IBM Selectric typewriters. The print is formed by the impact of a letter shape on the paper, just as it is formed when using a typewriter. The

print quality is indistinguishable from that of a typewriter and is suitable for formal or official correspondence.

Modems The modem (MOdulator/DEModulator) is a device which converts computer output to audio signals, can transmit these signals over phone lines, and can decipher such signals from other computers. The modem allows the computer user to make contact with other computers and use large databases or communication networks.

Graphics tablets The tablet allows one to draw pictures on the monitor and save these pictures on disks for future use. CAUTION! If you cannot draw, the graphics tablet will not make you an instant artist--I speak from personal experience.

Plotters The plotter will draw graphs, pictures, etc. on paper, and is very useful for showing output of statistical programs, spreadsheets, and any application where graphic presentation of data will assist interpretation.

Buffered interfaces This device "stands between" the computer and some other peripheral, usually a printer, and stores information until the printer can get to it. Simply put, the computer user constructs a document, sends it to the printer, and, after a short pause, depending on the length of the document, can use the computer to work on something else. The control over the printing, normally exercised by the computer, is done by the buffer, which feeds data to the printer when it is ready to receive it. This obviously increases processing and productivity since one does not have to wait until the printing is done to use the computer again.

Clock cards The clock is standard on some computers and keeps track of date and time. It is usually equipped with a battery to be used when the computer is turned off so that the date and time do not have to be reset each time the computer is turned on. The advantage of having the clock is that the computer user can, by writing a program or using commercially available software, have the computer run a program in the absence of the user. For example, the user could turn on the computer before leaving the office and have it access a database, using a modem, at 2:00 a.m. when the phone rates are low and there are fewer people trying to use the database.

Special keyboard Due to the poor design of some keyboards, manufacturers have developed additional keyboards that simulate a typical typewriter keyboard, have a number pad, etc. Perhaps in the future, new designs will consider the needs of the user, and not the desires of the designer, thus eliminating the need for add-on keyboards.

Surge protectors Fluctuating current is a problem in many locales. In the worst case, power surges not only disrupt the operation of the computer, but also may physically damage the unit. The surge protector keeps dangerous power fluctuations from affecting the computer.

Fans A small fan can keep the air circulating evenly in the computer and prevent overheating. Fans are built into some models and others, like the Apple II, have add-on fans available. Recent computer designs lessen heat problems by using fewer chips and chips that produce less heat.

Joy sticks and game paddles These are used to move the cursor or game piece around the screen, and can also be used with some software to simulate a pencil for drawing. The importance of using games to introduce novices to computer use is often not given adequate attention in computer implementation. Gaming provides a very non-threatening introduction to computers and can spur the beginner to investigate more practical uses for the system.

Network systems Networking will be one of the major trends in the 1980s. By connecting a number of computers together--using modems, cables, or both--more efficient use of mass storage (hard disks) and peripherals is possible, since each user can access whatever peripheral is connected to the network. Software to permit electronic mail and electronic conferences can speed communication. Purchase of software that can be used on a network and can be legally duplicated (not all can) means that instead of purchasing 10 identical programs to serve your student body, you can purchase one and have the students download it to their machine from the hard disk (i.e., transfer the program into their microcomputer's RAM). Future cable TV installation will allow connection of microcomputers as well as televisions and video recorders. The ubiquitous cable will become a natural extension of the computer network.

Card readers and optical scanner In many cases, there is a need for large amounts of data to be entered into the computer. Input by keyboard is tedious

and time-consuming. It is much more practical to collect the data on a medium which can be fed directly to a device connected to the computer, thus avoiding the possibility of data transcription errors and substantially decreasing the lag time between collection and availability for analysis. The data can be collected using "mark sense" cards, or sheets of paper with room for hundreds of items. The optical scanner or card reader interprets the marks and transmits this data directly to a file for later use.

Interactive video interface and videodisk or vcr One of the most exciting advances in computer-assisted instruction is the introduction of Computer-Assisted Interactive Video Instruction (CAIVI). Quoting from Computers in Nursing, March-April 1984:

> CAIVI is a relatively new technique in CAI which joins the interactivity possible on the computer with the realism possible on a video medium to produce unique and innovative training. The learner must no longer sit passively in front of a television screen or stare at screen after screen of computer generated text. Instead, the computer program controls the presentation of sections of video based on the responses the learner makes to questions. A correct response will show one scene, while incorrect responses will generate remedial video or scenes depicting the consequences of wrong decisions. The applicability of this technique to nursing education, where incorrect decisions may have deadly results, is obvious. The instructor, with the help of a video production staff and actors, can produce simulations which graphically depict the outcome of various decisions. The CAIVI (Computer-Assisted Interactive Video Instruction) simulations which can be produced with this technique approximate the presence of the instructor and the student in the actual situation without the accompanying danger. It is not feasible to allow the student to make that last critical move which could harm a patient. With CAIVI, however, the student is allowed to make the mistake and view the results of his/her errors. It is much more effective to have the student see a patient shudder and die on the screen than to have the words "Patient expires." printed there. It is my firm belief, and that of many involved in CAI, that CAIVI will become the dominant methodology employed in computerized education.

COMPUTER SYSTEM DESIGN

Determining the Needs

The first step in computer system design is determining the need by answering the following questions: what, when, who, where, how much.

What refers to the objectives that you wish to accomplish. It is very important that you are pragmatic and plan small--establish goals that can be met and your enterprise will be successful, and will look successful to outside observers (including funding agencies). Unrealistic plans will inhibit future use.

When you want to accomplish the "what" is also important since this dictates plans for acquisition of personnel and equipment. The time to begin planning for implementation is today, and the time to implement is as soon as funds are available and planning is completed. I would suggest that you plan to start involving your students on a regular basis one semester after the equipment arrives. This will give you sufficient time to "work the bugs" out of the system, get faculty trained, and purchase additional equipment or software suggested in pilot use. Again, plan full implementation over a period of time, because your first efforts will give you valuable experience in overcoming obstacles.

Answering the Who question means you will have to decide what group(s) in your school to impact first. My suggestion is that you plan this as a dual approach. You must get the faculty involved to sustain the enterprise; they will start to work on the system and then involve their students. You should also plan to impact at least one class or level of students during the first year of the operation. This entails purchase of software for faculty use (word processing and statistics, for example) and student use (drill and practice in math calculation or dosages and solutions, clinical simulations) and scheduling use so that both groups have time to get used to the system. After you have made preliminary decisions in these categories your next task is to open this for potential users. However, you should have a plan in hand since this will add legitimacy to your task and also give nay-sayers less opportunity for attack; collect a "cadre" of enthusiasts and jointly develop a plan. Do not spend time making converts at this point, rather, work with the people who are already committed or are at least interested. The "non-believers" will soon recognize that for their own advancement and preservation they will have to come around.

Where the computers will be placed is important since this may require modification of the physical plant which, in turn, may require a long lead time and

expenditure of funds. The location should be secure and should also be inviting enough to motivate students and faculty to drop in and learn about and on the computers. This is the time to consider purchase of portable or transportable computers which can be taken home by the users and returned the next morning. Such a plan substantially increases the time computers are available for use; you get more out of your equipment if it is not sitting idle for 12 hours at night.

How much money is available is always a bottom-line question. Make your plans over a three-year time period, projecting your funding needs during that time. This encourages you to plan your purchases systematically so that you do not buy whatever is available just to have something. This may mean starting with one or two expensive computer systems rather than a half dozen inexpensive computers, but you should buy capabilities and quality and not be "price blind." Planning over three years also gives you the opportunity to start the process of applying for funds for year number three now. Three years is recommended because the technology changes so fast that attempting to plan beyond this time will mean you are "working" with equipment which is obsolete--not only in design and structure but also in concept. Buy the best you can afford and build from this base.

Sources of Information on Computers

Trade publications The variety in depth and type of trade publications can be quite bewildering to the beginner. If you are setting up a computer lab or learning center, the following should be included as basic reference material: *Byte, Infoworld. Creative Computing, Popular Computing.* Also, subscribe to one of the publications devoted to the type of computer(s) in your installation, e.g., *PC World (IBM) or Softalk (Apple).* Providing these materials will assure a good flow of information to all users.

Journals Currently, there is only one journal devoted to computers in nursing, *Computers in Nursing,* published by J. B. Lippincott. Other publications of interest are *Computers in Healthcare* and *The Journal of Education Computing Research.*

Experts Consultants can be very helpful and cost-efficient if used correctly. Bringing someone in for a day or two and spending $1,000 to do so can save 10 times

that much in mistakes. Remember, though, that the expert leaves and you must live with the consequences. Develop in-house experts and pursue computer experts in other departments of your school or institution. Avoid being provincial in your selection of computer consultants; as this presentation shows, many principles of computer use cross disciplinary borders--don't be afraid to consult a non-nurse.

Trade shows One way to develop in-house experts is by sending your personnel to shows, exhibits, and training sessions.

Selecting the System

The size of the system will be dictated in part by the answers to what, when, who, where, and how much. Furthermore, software should be selected before proceeding with hardware selection (see suggestions made by Dr. Donna Larson, page 37). In current applications, the most advantageous type of system is one that can be expanded to meet new needs and to incorporate new technology. This usually translates into a decision to purchase a number of microcomputers rather than one large minicomputer. In addition, should you have access to a mainframe computer, the microcomputer offers a distinct advantage over purchase of terminals. When the large computer goes down, as they are wont to do, the microcomputer can be used as a "stand alone" unit for many purposes. When the mainframe is operating, the microcomputer, with the use of appropriate software and hardware, can be used as a terminal. Most educational software for nursing is being written for microcomputers; this should be considered when deciding the size and type of system to buy.

Whatever type of system is purchased, selection of type of peripherals will depend on the needs and priorities you have identified. The importance of adequate planning appears in every step of this process. The minimum computer configuration is a system with two disk drives, color monitor, and preferably a printer with a buffer. If your system has, or is planned to have, more than 10 computers, a network system, such as CORVUS Omninet, should be considered.

The brand of computer and peripheral that you choose can haunt you for a long time. It used to be easy to choose a manufacturer since there were so few to choose

from; now there are over 250 manufacturers of microcomputers. Currently, the most important factor in selection of any hardware is to ensure that the software you have, or can buy, to do a particular job will run on that piece of hardware. If you choose your software first, you have the option of purchasing the most desirable computer, both in terms of cost and features, that can use that software. Should you purchase the hardware first, you will be forced to choose from the software that will run on that machine and, perhaps, not accomplish the task you want accomplished in the manner you desire. While it becomes more and more difficult to predict who will and who will not be in business next year, consider that nursing publishers are focusing on Apple and IBM and that buying those machines, or compatibles, is safe. A compatible machine should be able to use the program written for its "companion," and also to read files written by the companion and to write files that can be read by the companion. It is possible, for instance, to buy a computer that will outperform the IBM PC for less money and still be able to run the software you want. Check with the software publisher to find out if his software will run on the compatible in which you are interested. At all costs avoid the "no-name" computers which, while cheap, are lacking in reputation and support. It is perhaps in the selection of hardware that a consultant can be most helpful, since it is the consultant's job to stay well enough informed to predict potential problems and help guide you through the morass safely.

COSTING THE SYSTEM

The direct costs of buying the hardware and software are the most obvious and, in some ways, the easiest to work with. In many cases, equipment will be bought on state contract and the most imaginative part of the process is coming up with unique reasons why the computer equipment or software on contract will not meet your needs in order to justify purchase of more appropriate materials. Even when buying on state contract or using public moneys, however, the purchaser must be aware of the support, or lack thereof, that can be provided by the vendor. When writing bids, always require that the price quote be for the equipment delivered, installed, and demonstrated. This ensures that the vendor is providing you with something you can begin to work with immediately. Demand such treatment for your money and shop until you find a vendor who will provide it. Lastly, unless you

have a great deal of experience with computers, you are safer buying all your equipment from one vendor. If any part of the system goes down you need to make only one phone call; also, the vendor will be familiar with your entire system and be able to suggest the best use.

If you are experienced in working with computer systems or have access to someone who does, the advantages of mail order buying are obvious. In most cases, you can buy hardware or software for about 30 to 33 percent less than from a computer store. You should check out the company involved if you are sending it large amounts of money by calling credit references, its bank, and by checking with the better business bureau for the city in which it is located. You should know, however, that if you buy mail order, the local vendor for that particular piece of equipment may relegate it, and you, to the the bottom of the list when time for service or troubleshooting comes. This is very unpleasant, but understandable, since local vendors must service first those clients who bought from them. In the case of buying software, however, mail order offers a price advantage and there is less risk. If you have never used a software package before and the package is quite complicated, you should buy it from a source where help is readily available. If there is in-house experience, or if the program is reputed to be easy to use, mail order is your best bet.

Pick a vendor by asking others what their experiences have been and by visiting the shop and discovering for yourself how helpful the company wants to be. If you have done some planning and reading beforehand, you can enter the shop armed with information and test the personnel on knowledge of the product. When picking software, I recommend visiting a store that sells only software. The selection will be much better than in a store which concentrates on computer sales, and the personnel will have experience with more programs. In a "hardware" store the personnel may push a product that they are familiar with or that the computer manufacturer packages with the system.

The indirect costs of setting up a computer installation include the purchase of supplies, books, and publications; the funding of attendance at continuing education

conferences and user group meetings; and maintenance. When you plan for your system, estimate that about 10 percent of your computer equipment cost should be set aside for supplies.

Deciding what to do about maintenance is always a difficult question. You will have a warranty period on the equipment you buy; work the equipment as hard as possible during that period to discover what the weak links are. Printers and other mechanical devices are more prone to problems than the computers. When the end of the warranty period draws near, consider the problems you have seen, your budget, and the equipment which you cannot afford to be without for even a day in establishing the priorities for extended maintenance contracts. These contracts are never cheap and can total about 15 percent of the cost of your system. Unless you can afford downtime, however, you have little choice; support is important to a school or institution that cannot afford lengthy downtime. Demand a maintenance contract wherein the vendor indicates the turnaround time on repairs and the provisions for loaner equipment until repairs can be made. Some universities and colleges offer maintenance contracts on a narrow range of computers--this should be a factor in your purchase. Most persons who purchase a computer for home use do not buy extended maintenance contracts since their downtime is not critical. This is a decision that is based on the unique settings and applications for your computer system.

The forgotten costs of computer installation are critical to operation, but often overlooked in planning. The most important of these neglected considerations are personnel and updates and enhancements.

The personnel needed to effect a complete and efficient computer operation are different from those using the system in the school (that is, faculty and students). Included in this group are persons who are computer experts, or at least computer experienced, and programmers. It is difficult to set up a computer installation if all the users are naive. Even if some of your faculty or students have used or own computers, a computer installation needs someone who is knowledgeable about the system to oversee operations. This is not a task that can be assigned to

whomever happens to be in the room at the time. When planning for your installation, figure in the cost of a half-time (at least) position for someone to do these things. In an academic setting you may find such a person in the graduate or undergraduate program of the computer science department if no one is available in-house.

One of the areas where your computer expert can help is the acquisition of updates and enhancements to hardware and software. Since most equipment will be obsolete in three years or less, you should purchase additions that will extend the life of your equipment; this is less costly than purchase of new equipment every year. Software companies, too, bring out new add-on packages for their programs and this should be considered in your budgeting. Plan for 10 percent of your budget each year to be used for purchase of new software or enhancements to hardware and software.

One of the potentially more expensive forgotten costs is the amazing ability of neophyte and veteran computer users to discover new products they must have--otherwise, the computer lab might as well be closed or turned into a handball court. This highly infectious disease, "acquisitiveness," will begin to manifest itself from the day the first piece of computer equipment is carried in the door. I have suffered from this for years and do not expect, or desire, cure. If you have planned well for expansion you can treat the symptoms with small doses of money, but you will never cure the disease.

SUMMARY

In conclusion, purchase and efficient utilization of computers should be a top priority for any administrator who wishes first class status for her or his school. The use of computers will only grow, and the most important step to take is the first one of saying "Yes," and committing the time and money needed for implementation. This paper has covered, in great brevity, the significant points in planning for computer use. The most important thing to remember is the word planning. Without it, the computer system, regardless of funding, will never address your needs.

USING COMPUTER TECHNOLOGY IN ADMINISTERING A NURSING PROGRAM

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Personal computers could change the day-to-day activities of the nursing administrator to result in increased productivity, not only of the administrator, but of the staff. At this point, I cannot prove to you through research that the administrator's productivity will be increased by use of computers; however, although bottom-line decisions are usually human decisions, the administrator can construct a computer-based system of data to give support to the decision-making process. Another area in which the functions of the administrative office can be facilitated is in communication. There are two other categories of use of the microcomputer system by the administrator: personal assistance and task management.

I will describe some of the ways in which we have used computer technology to enhance the organization and administration of the University of Texas at Austin (UTA) School of Nursing.

The first computer equipment for the Research Center was purchased in 1977. Presently there are 12 Apple Computers, 4 CRT's, and 6 Compucorps in use in the Nursing building. Following our first use of computers, we have moved very rapidly to expand the use of this technology in every program in the School.

In 1980, a faculty committee in the UTA School of Nursing, chaired by Gary Hales, developed a five-year plan indicating a number of goals to be fulfilled in one-year segments. At the end of the third year, we find that we are ahead of schedule in some areas and on target in others; in no area are we behind schedule. Making a

plan of this type has been a useful tool for budgeting purposes. In the next few months we will reassess our status in computer technology and usage, and develop an updated plan for the next few years. That plan will include our definition of computer literacy for our graduating students.

When we first discussed the use of technology in the School of Nursing, our goal was to acquire a mag-card and a memory typewriter for the School of Nursing. These two machines almost seem like the horse and buggy now. Although they are still used to some extent, much of the material which is presently on the mag-card either has been or will be transferred to hard disks on the computer. In 1980, the 1980 to 1984 report on the predicted use of computers by the School of Nursing were these:

1. Purchase 4 stand-alone word processing systems (Compucorp) and one central processing unit (CPU).
2. Purchase 2 letter-quality printers to handle the output of the word processing systems.

We have accomplished these goals. Two of the word processing stations, the Compucorp filing unit and one letter-quality printer, have been installed in the Word Processing Center. This Center is used for general correspondence, for course outlines, for reports, tests, proposals generated by faculty, and most recently, for the self-study of the School of Nursing for the recent accreditation visit by the NLN. The third station and a letter-quality printer are located in the business office for the School of Nursing. Another terminal is used in the Dean's office for word processing for reports, speeches, newsletters, correspondence, and the faculty handbook. A fifth station is located in Continuing Education. This station is used for program designing and record-keeping, as well as for word processing. A master address list, which also contains demographic information and information on continuing education units, will be added to expand the present system.

The Continuing Education staff wonder how they ever managed before the Compucorp. Much of the last-minute preparation for workshops has been eliminated now that it is possible to prepare pre-registrant lists and registrations as received.

Prior to the word processor, it was necessary to wait as late as possible, arrange everything alphabetically, and then type. Inevitably, a late registrant would have to be listed out of sequence. This same list is easily converted to a final list of participants.

The formatting capability of the word processor has greatly facilitated preparation of frequently used forms, such as evaluation summaries, vouchers, and various standard reports.

In addition to the word processor, the use of a computer terminal to make immediate changes in the mailing list has reduced the cost of address correction charges and mailings that should have been deleted.

Another application, although not administrative in the purest sense, is computer use in our Learning Center. During the last academic year, staff and the School of Nursing Learning Center computerized software holdings. System 2000, which operates on the Cyber (one of the main-frame computers located in the University's Computer Center) was selected as a database management system because of its ability to handle large amounts of data and to complete rapid, efficient searches. With this system, we can update and correct listings as changes are needed. Using this system, three other files have been created--for film rental, for review data, and for work/study student data. During the time of inputting this data, we expended $164 per month for computer time-connection with the Cyber and $8.00 per month for supplies. We expect these costs to decrease in the future, since the data have now been entered. We will measure the cost-effectiveness of these files as we use them, beginning with fall 1983 semester.

In November 1982, an academic development grant was funded for the School of Nursing out of the President's office. The project was designed to demonstrate the application of interactive computer-video technology to nursing and the University computer.

When the system is completed, five microcomputers in the network with a CORVUS hard disk drive will enable students to learn basic skills and theory at their

own pace in a cost-effective setting. Videotape and printer links will be available as well.

Staff members on the Computer-Assisted Instruction Project NEMAS--a project funded for the first two years by a special project grant from the Division of Nursing (NU2604402) and funded for this last year by Lippincott Publishers, who will be marketing the program after it is completed--are developing an authoring system which faculty members will use to create instructional modules on the steps of the nursing process. Microcomputers and an interdisciplinary team approach have been utilized to combine nursing content with instructional design. Faculty evaluations are the basis of the ongoing system refinement.

Until this time, the only instructional computing available to our nursing students was through programming courses offered in other colleges and schools on campus. We plan to offer in spring 1984 a course in use of computers in nursing. In 1983-84, four computers are available to nursing students in the Learning Center. Based on our present student number and the hours which the Learning Center is open, we can only provide one-half hour of computer time per student per week. This will be barely adequate for courses leading to computer literacy. If we are to use computers as instructional tools for students, it is estimated that a minimum of two hours per week per graduate student and one hour per week per undergraduate student would be required. In order to meet this goal, we will need to have at least 10 microcomputer terminals in our Learning Center. This would require some physical changes in the Learning Center to allow for privacy for the students learning at the computers. Our goal is to graduate students, both graduate and undergraduate, who are well-versed in the potential uses of computers. We will do this through utilization of computers as instructional tools in the curriculum, and to meet specific objectives in core courses. The graduate (doctoral) students will have skills in programming in several computer languages. We no longer have the luxury of deciding if computer technology will be an integral part of the curriculum. It must be!

Another area of increased use of computer technology, and the first area of computer use, is the Center for Research. The Research Center, established approximately 10 years ago, has steadily increased services available to faculty and

graduate students. The primary mission of the Center is the planning, execution, and interpretation of statistical analyses.

As part of their mission, the staff in the Center instruct faculty and students in the use of computer hardware and software, consult on research design, assist with programming in FORTRAN, BASIC, and PASCAL, and consult in the preparation of proposals for theses, dissertations, and intra- or extra-murally funded projects. Staff members in the Research Center offer assistance to UTASN faculty and students in the areas of: design of research projects; literature searches; grant writing; data processing and computer analysis; and interpretation and presentation of results. Several terminals, microcomputers, and printers are available to students and faculty in the Center, and portable terminals are available for home use. The Research Center's terminals are connected to the University's Computer Center equipment, making the vast resources of the Computer Center available to faculty and students.

The Center for Research is funded both from state funds and from soft monies. During 1982-83, the Center staff participated in research development within the School by providing over 200 technical consultations to faculty and students. Many of them involved computer usage for research purposes. During this year we have observed a three-fold increase in the use of computers in research.

One of our faculty members, who has a joint appointment with a clinical agency, has used computer technology in conducting her research. She hypothesized that the length of the shift and the acuity of patients on units has a direct relationship to the "sick time" of staff nurses. She demonstrated by her study that these nurses in ICU/CCU with 12-hour shifts had more "off" time than their counterparts in less stressful situations. She was also able to demonstrate that those staff nurses with shorter shift time in ICU/CCU had less "off" time than their counterparts with 12-hour shifts on this unit.

Faculty collect their data, and they work with the Research Assistant, Research Associate, or Director of the Center to analyze the data using the computer.

This assistance not only expedites the interpretation of data, but it results in less error.

Great emphasis is placed on research and publishing results of the data by our faculty. Support provided them through use of the computers and by their support personnel has made this mandate less stressful for them.

We have many master's and doctoral students using computers to assist them in their research to fulfill requirements for courses and for their theses and dissertations.

Faculty will be encouraged to write grants that will include funding for computers. When writing grants to include the purchase of personal computers, some large universities allow a great deal of latitude for entrepreneurs in research computation. This results in evolution towards a local system and away from a time-shared central facility. In this situation, a research program is based on a philosophy of "bottom up entrepreneurship," with each faculty researcher or research group being responsible for obtaining funds from external sources to support their activities. Others believe that central systems give better utilization of capital resources. (Memo from Ross Shipman regarding visit to computer programs at Stanford and Berkeley, June 7, 1983.) To date we have not reached the point of needing to make a policy about this issue.

Our goals for computer application in research for 1983-86 are:

1. Provide support services to faculty research activity.
2. Provide support services to graduate students in thesis/dissertation activities.
3. Provide support to UTASN courses requiring computerized statistical analysis and/or computer-based search facilities.

Compucorp equipment was selected for administrative application because of the available software that is adaptable for use. It is used administratively for record processing, word processing, and multiple mailings. Records on biographical

information and employment status are maintained on prospective, current, and terminated employees; this information may be processed and retrieved in different ways as needed. Word processing is used for the more complex typing jobs, such as reports, speeches, newsletters, and procedure handbooks. Mailing lists are merged with letters or printed on labels to facilitate the dissemination of information to faculty, students, alumni, and supporters. Other general uses include maintaining a calendar of events for the School and sending and receiving electronic mail. (Electronic mail is not used widely on our computers at this time.)

We are writing a program for in-house use whereby three of our Compucorp work stations can be interactive. For example, when a prospective faculty member is interviewed, a note is made of that on the Compucorp in my office. The Assistant Dean can pick that up on her terminal and gain information about that particular person and the status of the interview process. Once the individual is interviewed, we will make a note of that and indicate recommendations regarding appointment, salary and rank, and the course the person is to teach.

Documentation is to be kept to follow up on the interview. If the individual accepts the appointment, that information is entered on the terminal, the business office will pick this up, will process the necessary papers, and then, as appointment letters are written, that too is documented on the terminal. Again, the Assistant Dean can pull this up and know the status of the prospective faculty member. When the individual accepts the appointment, this is entered and everyone concerned knows the status simply by reviewing the documentation on the Compucorp.

The data processing division is responsible for maintaining University records. Programmers there have evolved "user-friendly" programs which allow staff to assess and update information about personnel and about students. A micom port (telex terminal and printer) connected with data processing is located in the business office, where it is used for accounting, payroll, budget, and personnel.

Departmental accounting information is available. Terminal displays show current account information for appropriations and income, encumbrances, expenditures, transfers, and free balances. Signature authorization on the account, the

date of the last accounting activity, and the identification codes of departments and colleges are also displayed.

The Student Affairs Office is also connected with the data processing division with a telex terminal and printer. Many hours of travel to the Office of Admissions and the Registrar's Office are saved by use of this terminal. We use it for student records.

Information about prospective students who have not yet been admitted, admitted freshmen, transfer and graduate applicants, and enrolled students can be viewed. Another procedure allows up to five current semester class rosters, five student advising aids, or five unofficial transcripts to be printed at one time.

Care must be used to prevent unauthorized release of anything other than directory information on a student. Grades, social security numbers, and even the classes students are enolled in cannot be disclosed without the student's permission. Furthermore, if the student has requested it, even address information must be protected.

Student addresses may be updated by departments which have obtained approval through the office of the registrar.

An on-line procedure is now used for centralized "add/drops" during registration. The Registrar's Office enters the student's requests for adding and dropping classes into the computer files. A copy of the student's revised class schedule is immediately printed for the student. A few departments were selected to use the system for processing all "add/drop" requests in a pilot test during the fall 1983 semester; our school was one of these. The results of this test will determine whether the system will be available for use by all academic departments.

Data processing started out as a service to users by specialists; traditional data processing services are still handled in that fashion. Now, however, capabilities are provided without the specialist as an intermediary. Word processing has

followed the same path. It was initially a service provided by specialists, but it is now available to all. Most observers belie e that the users of the future will be non-specialists who regard machines as tools capable of processing mail electronically and gaining access to information. We will not concern ourselves with classifying functions as data processing, word processing, or other specialties. It is important to encourage personnel to be interested in developing these new skills, and broadening them to include information technology rather than concentrating on specialization. Another challenge will be the way information is managed. The approach to management of information in the future must concern itself with word processing, voice-mail systems, and microfilm or CRT-based graphic displays.

Although we found in our use of technology that we were able to reduce the number of secretaries, it is generally a misconception that computers will eliminate positions. Computers should be regarded as a supplement and a way to make the operation more efficient.

The ways in which computer technology can be used in nursing programs is limited only by the knowledge and imagination of the user. While I have described systems in use in one public university, I believe that each program must make plans for computer usage to meet its needs after looking at the reasons for computer use and the human and material resources available to initiate the program. Our progress in determining the various uses, costs of the programs, and the process of establishment of computer usage may be helpful as you plan to introduce this use to technology in your program.

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COMPUTER-ASSISTED INSTRUCTION IN NURSING EDUCATION

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Computer-assisted instruction (CAI) has been defined as one kind of learning environment in which, through the use of computer technology, a learner receives, reacts to, and interacts with instructional material prepared by an instructional specialist (Burson, 1976). Contained in this definition are two key concepts. The first concept is that the learner participates in active learning activities. Only through active and continual participation does the student progress through the instructional material. The student must interact with the instructional material. In well-designed computer-assisted instruction, there is no way that the student can be a passive recipient of information. The second key concept is that well-designed computer-assisted instruction individualizes the learning activities for each student. Within a specified framework, each student's own particular rate of learning and intellectual level can be accommodated. Through the use of branching and good instructional design, the same computer-assisted instruction program should appear very different to the "good" student than it does to the student who does not learn as readily.

ADVANTAGES OF COMPUTER-ASSISTED INSTRUCTION IN NURSING

Keeping in mind the key attributes in the above definition, the use of computer-assisted instruction has many advantages for nursing education.

1) Provides effective, efficient methodology. Research on computer-assisted instruction in health professional education has repeatedly demonstrated that, when compared to the more traditional teaching strategies (e.g., classroom lecture, discussion, lab), students learn equally as well with

computer-assisted instruction, but in one-third to one-half the amount of time (Bitzer, *Computers in Biology*, 1973; Boettcher, 1981; Droste-Bielak, 1980; Huckabay, 1979; Kulik, 1980; Larson, 1982; Rubinson, 1977; Valish, 1975). In this age of exploding knowledge in nursing, the saving of student learning time can be viewed as a tremendous advantage.

2) Equalizes learning opportunities. Because of such variables as the changing nature of client populations, contracts with clinical agencies, and student clinical rotation scheduling problems, many clinical experiences are not consistently available to all students. Computer-assisted instruction, especially the use of computer simulations, is one way in which variable clinical learning opportunities (such as in maternity and pediatric care settings) can be better equalized among students. Even if "real life" maternity nursing experiences are in short supply, at least all students could be provided the opportunity to practice planning nursing care for computer-simulated maternity clients. Computer-assisted instruction also can provide students with "rare" learning opportunities. For example, even though a particular geographic location may have a very small black population, students could still be provided with the opportunity, through the use of computer simulations, to plan and manage the nursing care of clients experiencing sickle cell crisis.

3) Provides repeated practice opportunities. Computer-assisted instruction allows students to have repeated trials prior to implementation of care for actual clients. Students can learn on the computers and then apply what they have learned while caring for actual clients in the clinical settings.

4) Offers safe practice environment. One of the primary advantages for the use of computer-assisted instruction in nursing education is that it allows students to make their errors in a safe environment. A computer is not going to become gravely ill because of an erroneous medication dosage calculation or a poor judgment in planning nursing care. Obviously, this is not the case with actual clients in the clinical settings!

5) Promotes creative problem-solving and manipulation of variables. The computer can open up the world of the "what if's" to student learning. Because no harm will come to actual clients, the student is free to explore many alternatives in solving patient care problems; the student is able to actively

experiment with many different hypotheses. The student could also be allowed to purposely make errors in order to validate his/her own ability to problem-solve how to remedy a deteriorating client situation. Due to our concerns for client safety, the student is not usually allowed to engage in this kind of learning (active experimentation) in the clinical setting. Because of our own limit setting, the student's creative problem-solving may be thwarted. Through the use of computer simulations, we could actually encourage the student to think more creatively.

6) Provides a private learning environment. Computers can provide a non-threatening environment for student learning. Computer-assisted instruction allows students to make their learning errors in private, without fear of ridicule from peers or of making a "bad impression" on faculty. The provision of this kind of private learning environment is especially important for the student who may be a slower learner.

7) Permits freedom from repetition. Computer-assisted instruction can free the instructor from the repetitive aspects of teaching, so that more time can be devoted to higher level teaching activities, such as assisting students to apply theoretical knowledge to actual clinical stituations.

8) Is cost-effective. There have been few attempts to determine the actual cost of computer-assisted instruction in nursing education. However, my own research on the effectiveness, efficiency, and cost of computer-assisted instruction in psychomotor skill development demonstrated that the cost per computer learner was $ .94 compared to $2.17 per skills laboratory learner. The difference in cost was due mainly to the decreased amount of faculty time required when computer-assisted instruction was used (Larson, 1981).

SPECIFIC TEACHING AND CONTINUING EDUCATION APPLICATIONS

Computer-assisted instruction has been used in nursing education for the past 10 years. The professional literature reports several very specific applications of this "new" teaching methodology in various aspects of nursing education.

Undergraduate and graduate nursing education. In the area of theoretical instruction in undergraduate and graduate nursing education, several studies and

reports have been noted in the literature. The seminal research into the effectiveness and efficiency of computer-assisted instruction in the teaching of nursing theory was conducted by Bitzer (*Computer-based Instruction*, 1973). She researched the use of the PLATO system in presenting maternity nursing content to diploma nursing students. Additional uses of the PLATO system to present computer-assisted medical-surgical nursing content to students at Ohio State University and the University of Illinois were reported by Collart (1973) and Kirchhoff and Holzemer (1979). Also at the University of Illinois, Rubinson and Robinson (1977) described their research on the use of the PLATO system to present an entire first aid course to students. Huckabay et al (1979) reported on research on the use of computer-assisted instruction to teach hypertension client management to graduate nurse practitioner students. Furthermore, Donabedian (1976) presented the results of research on the use of computer-assisted instruction in teaching epidemiology content to nursing students.

Computer-assisted instruction has also been used to teach various aspects of communication skills to nursing students. Kamp and Burnside (1974) described their use of computer-assisted instruction to teach therapeutic communication and interviewing skills to nursing students. Moreover, Droste-Bielak (1980) reported her research findings on the use of a micrcomputer-assisted instruction program to teach interviewing skills prior to a beginning level student's first community health home visit.

Another area in which computer-assisted instruction has been used in nursing education is in the realm of teaching clinical decision-making skills. Sumida (1972) reported on her use of computer-assisted instruction to evaluate terminal behaviors of both B.S.N. and A.D.N. graduates at the University of Hawaii. Further, Olivieri and Sweeney (1980) described their use of a series of four microcomputer simulations to teach clinical decision-making skills as a client experiences various phases of the health care delivery system (emergency room, cardiac care unit, medical-surgical unit, and cardiac rehabilitation program after discharge).

One would not ordinarily think that computer-assisted instruction could be used for teaching psychomotor as well as cognitive skills. However, it has been

demonstrated that selected nursing psychomotor skills can be effectively and efficiently taught by using computer-assisted instruction (Larson, 1981, 1982).

Continuing education. Because of its accessibility and self-paced format, computer-assisted instruction is particularly well-suited to the adult learner. Computer-assisted instruction is potentially accessible 24 hours a day, 7 days a week. Additionally, students can learn in their own time frame, at their own pace.

The literature describes the use of computer-assisted instruction in various staff development endeavors. For example, Hoffer et al (1975) reported on the use of computer-assisted instruction to provide instruction on cardiopulmonary resuscitation to "off-shift" nursing personnel. Hon (1982) also described his development of a tremendously exciting interactive videodisc/mannequin system for CPR instruction. Valish and Boyd (1975) reported on their use of computer-assisted instruction to provide in-service education programs on various aspects of client care management.

Computer-assisted instruction has also been used to provide educational opportunities for the registered nurse seeking baccalaureate nursing education. Reed et al (1972) at Ohio State University and Hannah and Conklin (1982) at the University of Calgary both describe the use of computer-assisted instruction to provide instruction to nurses in geographic areas distant from the universities.

The utilization of computer-assisted instruction in many aspects of nursing education is a beginning reality. Because of its many advantages, I believe that computer-assisted instruction has the potential to become a major methodological tool in nursing education. I invite you to join in my excitement over the potential benefits of this instructional medium.

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COMPUTER USE IN NURSING SERVICE

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One of the goals of nursing is to manage the conditions under which patient care is practiced; one of the goals of nursing education is to prepare nurses to function in this role. The purpose of this paper is to present computer usage by nurses in the clinical practice area and to address the challenges this technology poses to nursing practice and to nursing education.

As nursing care becomes more complex, the increased utilization of computers to coordinate and document that care becomes essential. At the Clinical Center, the research hospital of the National Institutes of Health (NIH) in Bethesda, Maryland, the Nursing Department is committed to the provision of care to patients and support to their families and to collaboration in biomedical research. The Clinical Center Medical Information System (MIS) is one of the tools used by nursing to manage patient care and to provide a data base for nursing research. This system provides a computerized method for handling patient care data. It replaces the traditional manual methods of communicating, recording, documenting, and archiving records. Its usefulness and advantages lie in its ability to perform at high speed and with precise accuracy, according to specific written instructions (programs).

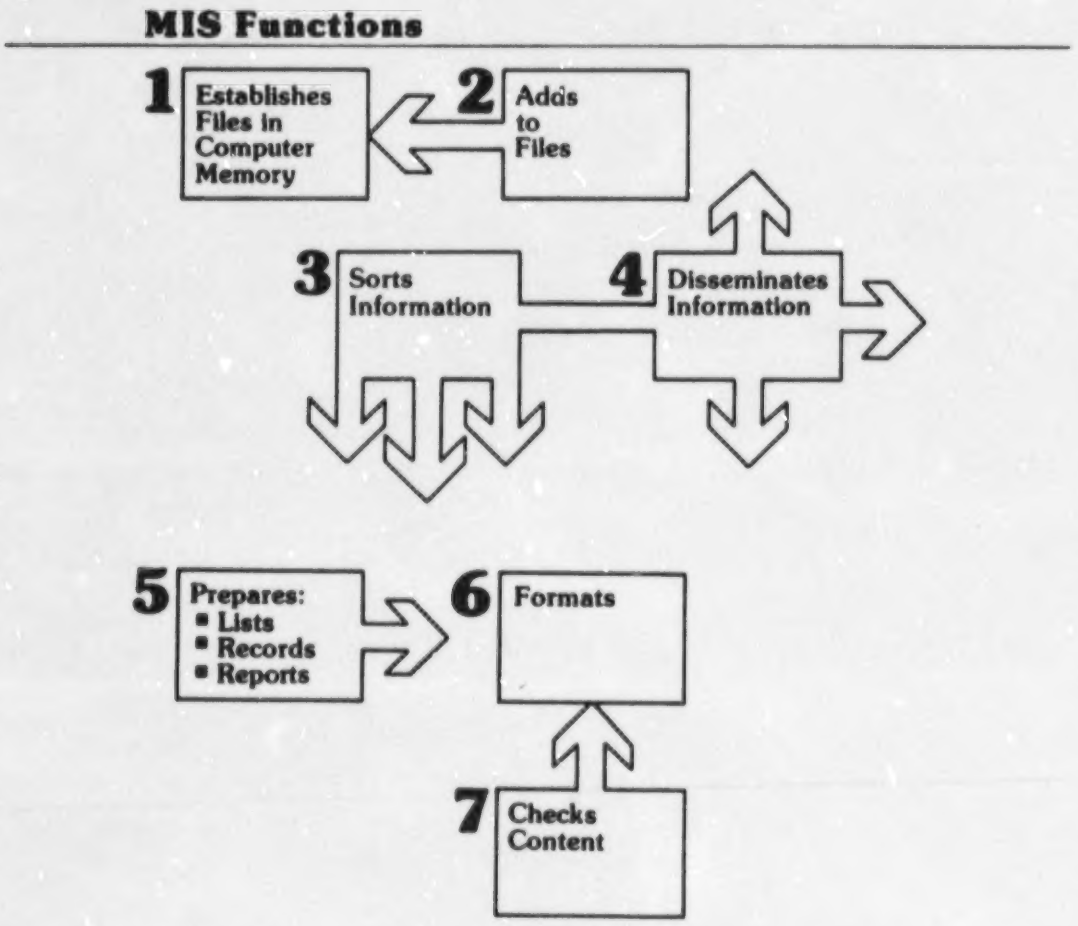
For nursing to effectively use this tool and exploit its potential for enhancing patient care, a critical analysis of nursing practice is required. A definition of information handled by nursing, nursing activities and functions, and a nursing content

framework for documentation is needed. The Clinical Center Nursing Department addressed these requirements through intensive nursing participation in the design, development, and implementation of the Technicon Computerized Medical Information System.

To understand what a computerized MIS can do to facilitate the management of patient care, one needs to assess the functions of an MIS from a nursing perspective. Seven major functions can be identified (see Figure 1).

FIGURE 1

Seven Functions of a Medical Information System



1) Establishing a patient file in computer memory enhances the availability and retrievability of patient information. This capability provides an obvious advantage in a research environment where data collection and retrievability of information are a significant part of the research process.

2) The Clinical Center computerized system provides the ability to add information to a patient's file in a direct (on-line), real-time (as events occur) basis, thus creating a dynamic, current patient record. In a manual system, this activity can be compared with making daily additions to the patient's record so that the chart reflects the current patient status at all times. The computer advantage, however, emphasizes the legibility and accessibility of patient information.

3) Another function is that of sorting data. Sorting and classifying data have traditionally been the function of nursing personnel. For example, transcribing written medical orders involves the nurse's classifying and sorting a list of orders onto sections of a Kardex. This activity allows for information to be organized into a useful format to communicate nursing care requirements to all nursing personnel. A computerized MIS is used by physicians for "writing" medical orders which are then automatically sorted into categories and printed into a computer-produced Kardex used by nurses. This computer printout, or medical care plan, sorts the orders into the categories of vital signs, medications, IVs, hygiene/activities, procedures, diet, other departments, and is printed at the beginning of each shift. It reflects any revisions made to the medical plan so the nurse has the most current data base from which to practice.

4) The MIS functions to disseminate information to other departments throughout the hospital in the correct format and at the appropriate time. In a manual system, initiating, completing, and dispensing requisitions involves a large percentage of nursing time--the medical order transcription process. The Clinical Center MIS automatically notifies the pharmacy department of medication orders, the nutrition department of diet changes, and the radiology department of requests for X-rays. This automatic communication of information frees the nurse of the clerical responsibilities related to message and requisition handling of this kind. In addition it provides for the accuracy,

completeness, conciseness, and timeliness of communications that are essential to information handling in a hospital environment.

5) The preparation of lists, records, and reports is also identified as an important function of an MIS. A variety of lists are produced to facilitate nursing's management of patient care. For example, medication lists produced automatically each hour replace the traditional medication card system of dispensing medications; a list of unreported medications reinforces the timeliness and completeness required in documentation. The Nursing Record, a computer printout comparable to handwritten nursing or progress notes, is produced daily and encompasses all nurse charting, i.e., vital signs, medications, and observations recorded within a 24-hour time frame. In addition, X-ray, laboratory, and other department reports are also automatically printed on the nursing units immediately after they are recorded by the appropriate departments. Consequently, this system eliminates the traditional "mailing" or "hand carrying" methods of communicating patient information between hospital departments.

6) In contrast to a manual recording system, a computerized MIS provides a mechanism for structuring the type and quality of information communicated about patients. For example, the format required for documenting an injection dictates that the injection site be recorded by the nurse; the format for charting a medication as "not given" requires the nurse to record an explanation or reason for the patient's not receiving the medication.

7) Finally, an MIS reviews the predefined formats for entering information and responds with a message to the user if the format is not adhered to. This checking mechanism can be viewed as a method for controlling the quality of information recorded by users. Because it is the user, not the computer, who determines the appropriate formats for data entry in system development, the function of the computer is to reinforce the user's decisions for quality control in communication and documentation.

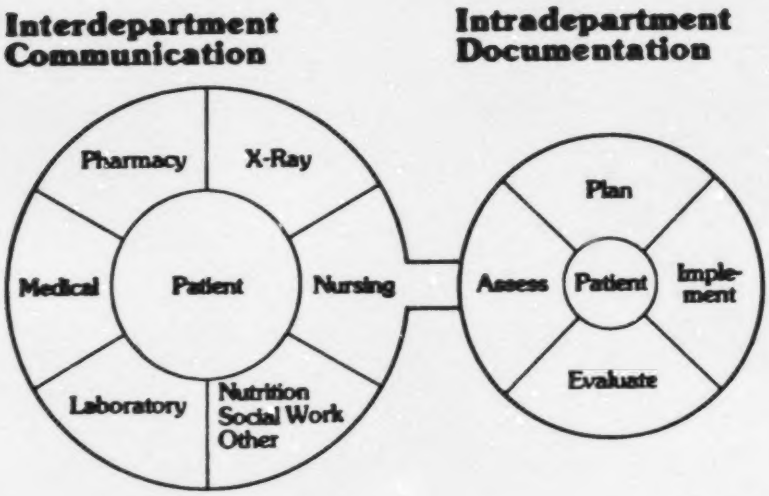
As a computerized method of handling patient care information, the Medical Information System facilitates communications, patient care, and research at the Clinical Center. As a communications network, the system links physicians, nurses,

and all departments. Video matrix terminals (VMT) (input devices for sending and receiving messages) and printers are located throughout the hospital in all nursing units, all departments, and some offices. These devices, in turn, are linked to a larger IBM mainframe in the hospital. Patient-related information sent and received via MIS is readily accessible to appropriate departments. Confidentiality and availability are controlled through user class codes. Each code reflects the position descriptions of a class of users and allows for accessing the information needed to carry out designated responsibilities.

Two major uses of MIS can be identified for nursing: 1) the facilitation of interdepartmental communications and, 2) the facilitation of intradepartmental documentation (see Figure 2). Traditionally, nursing has accepted the responsibility for

FIGURE 2

Major Uses of a Medical Information System to Facilitate Interdepartmental Communication and Documentation



coordinating the communication of patient-related data. In a large multidisciplinary organization this places increasing demands on nursing time as the nurse disseminates information from the patient's chart to other departments which need that data but are physically removed from the area where patient information is housed. Via a computerized communication network, the pharmacy department need not phone the nursing unit to identify patient medication profiles or allergies; the nutrition department need not request patient location or diet change information from nursing; and preoperative requests for laboratory data are no longer made to the nursing department but, rather, can be directly accessed via the computer system.

Nursing documentation is also facilitated through the MIS. Legally and professionally, documented nursing care is interpreted and translated to reflect the nursing care that was given. The development of nursing content to reflect nursing practice necessitates critically analyzing how nursing is practiced and organizing the process of nursing into a finite framework. At the Clinical Center, the Nursing Department's philosophy about nursing practice directed this content development. Information was organized to reflect the nursing process and to define the independent and interdependent aspects of nursing practice.

Interdependent nursing encompasses the nursing interventions that require a medical order for validity. Documentation of these activities taken on the patient's behalf involve the nurses' recording of 1) business activities, such as admission, transfer, and discharge; 2) patient activities and procedures, prescribed to and for the patient in the medical plan, which the patient is legally, physically, emotionally, or conveniently unable to execute without nursing intervention; and 3) medications, intravenous therapy, or blood component therapy that involve communication and coordination with other hospital departments. The nurses' responsibility for documenting these activities involves recording the medically ordered activities as "done/not done" or "given/not given" so as to validate implementation of the medical plan.

Independent nursing is defined as the area of practice involving health problems that nurses can independently identify, influence, or resolve and interventions that complement the medical plan. The focus of nursing care in this area is patient

needs; thus, the framework of 13 patient-need categories defined by the Clinical Center Nursing Department is used for documenting this aspect of nursing. This framework allows for the systematic organization of data and was used to develop assessment, care planning, and reassessment content for nurse documentation.

As described in the model by Romano et al (1982), nursing information is clustered into the three major categories of assessment, care planning, and reassessment. The nurse records assessment data by addressing a patient's specified pattern in each need area, any impairment related to meeting the need in that area, and any aids used to facilitate the need. Recording aids currently used and identified by the patient as part of the admission process provide the opportunity to assess the patient's level of self care and to begin addressing continuity from home to health care setting. Nursing assessments are printed on a daily computerized nursing record that reflects all nurse charting for that day.

Care planning data is recorded by identifying the appropriate nursing diagnoses, expected patient behavioral outcomes, and nursing actions that address meeting the patient's needs. With a primary nursing system of care delivery, it is the primary nurse who identifies how frequently each outcome will be evaluated and when the projected deadline for accomplishment is. The nurse then defines and records the expectations for documentation for which he/she is held accountable.

Care planning data is retrieved on the Nursing Care Plan, a computerized printout that reflects nursing diagnoses, patient outcomes, and nursing actions. This document is printed as requested and always at the point of discharge. It reflects all nursing planning done from admission to discharge and is included as part of the patient's permanent record. Each patient at the Clinical Center has two care plans: 1) a medical care plan to organize medical orders related to the medical diagnosis and research protocol, and 2) a nursing care plan to organize nursing orders related to the nursing diagnosis and research protocol.

Implementation and evaluation of the nursing process are recorded in the data cluster called reassessment. This cluster is appropriately named because implementation of care involves the delivery of care as well as the reassessment of a

patient's response; evaluation of care involves the analysis of the patient's reassessed response in relation to the anticipated response defined in the plan. Delineation of a course of action is then pursued by the nurse. Documentation of implementation and evaluation on the MIS is accomplished by recording procedures and observation in the appropriate patient need categories.

As in the dynamic process which it reflects, the documentation of interdependent nursing actions and independent nursing actions merge in the recording of patient responses. Professionally and legally, the unquestioned independent area of professional nursing is the responsibility for making observations and recordings about patient responses, that is, patient responses to the medical plan as well as to the nursing plan (Lesnik & Anderson). Computers are used in clinical practice to support and foster the documentation of those patient responses--the documentation that reflects the cognitive and evaluative aspects of care entrusted to nursing.

An examination of computer use in clinical practice stimulates new challenges to nursing education. Computers can force the closing of the gap between nursing education and nursing practice by fostering the application and documentation of nursing frameworks and nursing theories. They can force the emergence of full professional roles by executing the information-handling, non-nursing functions traditionally assigned to nursing in the health care environment. However, to prepare nurses to practice in the increasingly technological environment of the future, and to direct and control the impact of technology on nursing, is no small challenge. But, as with any challenge, one must take that awesome first step. An awareness and involvement with the state of the art of computers and technology in health care can be that first step. A goal of nursing education can be to maximize the potential of the new tools of our society so that the computer, like many other once-new tools, can enhance the practice of professional nursing.

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NURSING EDUCATION MODULE AUTHORING SYSTEM (NEMAS)

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The Nursing Education Module Authoring System (NEMAS) has two major sections: an authoring component and a learner delivery component. The authoring component allows faculty to create instructional modules. The learner delivery component delivers the instructional module to learners and records their responses.

The authoring component of NEMAS allows nursing faculty to create computer-assisted instruction (CAI) modules on any of the five steps of nursing process, i.e., nursing assessment, diagnosis, planning, intervention, or evaluation. The authoring system, consisting of computer programs, prompts authors for both content and instructional decisions in creating learner modules. Authors first use a NEMAS utility to create a patient. The patient data is then used as the content base for an instructional module on one of the nursing process steps. Next, authors enter prerequisite assessment items, instructional module information (including feedback messages for learners), and outcome assessment items. By using NEMAS utilities, authors transfer all the information to learner module disks. Authors are thus able to create a learner CAI module without having done any computer coding or programming.

The learner delivery component of NEMAS consists of programs which present the learner module (containing the faculty's authored content) to users. Learners are directed through the three parts of a module: prerequisite assessment section; instructional section; and outcome assessment section. The prerequisite assessment section consists of multiple-choice items used to determine learners' entry knowledge. Authors can provide essential information for learners who do not answer prerequisite items correctly through the use of corrective paragraphs for each prerequisite item. The instructional section of the learner module requires learners to

make decisions based on the patient data created for the nursing process step. In the outcome assessment portion of the module, learners respond to multiple choice questions created by faculty authors. Learners' scores on assessment items and several selected responses from the instructional section of the module are recorded on a learner record disk. The information on each learner's record disk can be reviewed by the faculty author using a NEMAS utility.

NEMAS is designed for authors and learners who have not had computer experience. Menu selections allow easy use of both the authoring and learner delivery components. The system has been implemented for use on a personal microcomputer using floppy disks. The system currently operates on an Apple II Plus, DOS 3.3, with a language card (64K) and double disk drives.

NEMAS documentation consists of an authoring manual with a variety of useful appendices, and wall charts for both authors and learners. The first chapters of the manual are tutorial in nature, guiding authors in a step-by-step manner to learn use of NEMAS. Later chapters, i.e., reference chapters, offer further explanation about how to use the system to its maximum. Examples of patient data and a sample learner module are presented to orient faculty to the use of NEMAS. One chapter explaining NEMAS can be copied for distribution to learners.

In summary, NEMAS is a template authoring and learner delivery system on nursing process. It incorporates principles from instructional design, learning theory, and nursing process theory. The learner modules created using NEMAS can be tailored for difficulty level by faculty. New modules reflecting updated knowledge can be created easily. Since nursing process is used in all nursing practice areas and taught in most types of nursing education programs, NEMAS' use is not constrained by practice specialty area, type of nursing education program, or any particular curricular conceptual framework.

NEMAS: Nursing Education Module Authoring System. Supported by DHHS, Division of Nursing (D10 NU26044), 1981-1983; and J. B. Lippincott Co., 1983-84. Susan J. Grove R.N., Ph.D., Project Director. © The University of Texas at Austin, School of Nursing, Austin, Texas 78701, 1983.

DRUG THERAPY COURSE

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The computer-assisted drug therapy lessons were developed by three nurse educators in the Department of Nursing at Talmadge Memorial Hospital, which is the clinical teaching facility at the Medical College of Georgia.

The lesson material was developed to be used by licensed nursing staff both during their initial orientation and as an ongoing review and update. All nursing employees who have responsibility for administering drugs at Talmadge Memorial Hospital, Medical College of Georgia are required to successfully complete a medication test during orientation and at five-year intervals. The computer lessons serve as remedial reviews for nurses who do not meet the established standard for the drug categories tested. The lesson material is also used by nurses who have a "felt" learning need in any drug category.

The course consists of 15 lessons: Antibiotics, Gastrointestinal Drugs, Antidiabetic Drugs, Respiratory Drugs, Antiallergic Drugs, Sedatives/Hypnotics, Analgesics and Antagonists, Anticonvulsants, Glucocorticoids, Antihypertensives, Digitalis, Antianginals, Antiarrhythmics, Diuretics, and Anticoagulants. Plans are being made for the development of additional lessons.

Each lesson is a series of multiple-choice and short answer questions. Remediation is offered for all wrong answers and rationales are presented with the correct responses. When appropriate, a short review, either required or optional, is

offered on disease entities for which the group of drugs is used. Drug action, expected therapeutic effects, possible adverse effects, patient education aspects, and pertinent nursing responsibilities associated with the group of drugs are covered. Optional scored self-assessments are available at the end of each lesson. Study guides which are sequenced with the computer lesson are also available.

The lessons vary in length from approximately 45 minutes (Antianginals) to three hours (Antibiotics). The total length of time required to go through all the lessons ranges from 17 to 24 hours. Some new nurses, particularly the graduate practical nurses, may require up to 30 hours.

Each lesson has been reviewed by clinical specialists, other nurse educators, experienced practicing nurses, and faculty members at both baccalaureate and associate degree programs. Use of the initial lesson material was begun in June 1981. Ongoing evaluations by nurses using the lessons have been used for lesson revisions. Data have been collected relating to attitudes concerning the use of computer-assisted instruction in the staff development setting. The results of these surveys will be published at a later date. Preliminary indications are that the use of the computer for instructional purposes has been received very positively at our institution.

The project was begun in 1980 on two Apple microcomputers and was funded by a grant from the Apple Education Foundation. Lesson material has been authored using the CAI System that was developed by Dr. Richard Pogue, Medical College of Georgia. The system is easy to learn, does not require that an author learn a programming language, and allows an author to use whatever instructional strategy is appropriate to the learning need. Lessons developed using the system can be run on a variety of microcomputers.

The lesson material will be available for purchase in 1984. Information can be obtained from Lucille Pogue, R.N., M.S.N., Department of Nursing, Talmadge Hospital, Medical College of Georgia, Augusta, Georgia 30912.

SURVEY OF MICROCOMPUTER USE IN SOUTHERN NURSING EDUCATION, 1983
Report of Findings

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In early 1983, informal reports from schools of nursing in the South showed a surge of interest in computer technology. The Executive Committee of the Southern Council on Collegiate Education for Nursing had already planned that the next annual meeting of the Council would address the needs of deans and directors, as administrators, in using the technology. It was also believed that a special regional project should be planned, to assist the schools' faculties in using computer technology as an instructional tool.

A questionnaire survey was conducted, therefore, to gather information as a basis for planning the meeting of deans and directors and a regional project for faculty. For practical reasons, the questionnaire was mailed only to deans and directors; they were asked to give their opinions about their faculty's knowledge, experience, and interests concerning computer instruction, and to report their personal interest concerning the technology. The questionnaire was mailed on April 15, 1983, to the nurse administrative heads of all associate degree and baccalaureate nursing programs in the South (342). By May 5, the deadline date, responses had been received from 75 percent of the schools as follows:

Associate degree programs	152
Baccalaureate programs	84
Schools offering both programs	21
Total	257

This report summarizes the responses from these 257 nursing program administrators.

Kathleen J. Mikan, University of Alabama in Birmingham, assisted in the preparation of the questionnaire. Ethel Tatro, Georgia State University, handled the tabulation of responses and assisted in the analysis of findings.

ADMINISTRATORS' INTERESTS

Most of the administrators (83 percent) reported that they had little or limited knowledge about computers; only nine persons rated themselves as highly knowledgeable. However, more than half said they have used the computer for some purpose, most commonly for administration and less often for research or instruction. Only 13 percent of the individuals had not used computers for any purpose and did not plan to do so. A few (15 percent) had a personal computer at home. The majority said they would like a hands-on microcomputer demonstration at the 1983 Council meeting.

The nurse administrators reported that microcomputers are widely available on their college campuses, especially for use by non-nursing students, and are available to a lesser, but growing, extent to nursing students.

At 89 percent of the institutions, microcomputers were available for use by students enrolled in non-nursing majors (e.g., math, science, engineering). At 30 percent of the institutions, nursing majors received some of their pre-nursing or non-nursing instruction through use of microcomputers.

While only 14 percent of the schools reported that nursing majors receive some nursing instruction through microcomputers, many schools indicated they had recently purchased the machines and plan to use them for nursing instruction.

Over a third of the nursing programs currently had microcomputers available for instruction in nursing courses, and half of the programs expected to have them within the next year. Some of the schools that did not have microcomputers commented "We have none because faculty don't know how to use computers;" "Individual faculty members have them, but the school cannot afford them." Some schools that already have microcomputers said they plan to buy more, "as soon as the faculty learn to use them."

The microcomputer hardware most commonly available in the nursing programs is the Apple. The 93 nursing programs that currently have microcomputers

reported a total of 331 Apples, 111 IBMs, 73 TRS-80s, 5 Commodores, 3 Digitals; there were 109 microcomputers of various other brands. The Apple is the brand that was named most often by schools that expect to purchase hardware within a year.

FACULTY NEEDS

As Table 1 shows, all of the responding schools reported that faculty have a moderate or great need to learn about the use of computer technology for education purposes. None of the schools said faculty did not need to learn computer use. (One school did not respond to this item.) A very high percentage of responders stated that the faculty have moderate to great need to learn about: developing software (96 percent), selecting appropriate software (98 percent), and overcoming fears of computer technology in instruction (88 percent).

TABLE 1*

Schools Reporting that Faculty Have
Moderate or Great Need Related to Microcomputers

		Bacc.	AD	AD/Bacc.	TOTAL
Learn Use of Computer	N	83	152	21	256
	(%)	(99%)	(100%)	(100%)	(100%)
Learn to Develop Software	N	78	147	21	246
	(%)	(92%)	(97%)	(100%)	(96%)
Learn to Select Software	N	83	147	21	251
	(%)	(99%)	(97%)	(100%)	(98%)
Overcome Fear of Computer	N	75	131	21	227
	(%)	(89%)	(86%)	(100%)	(88%)

*The tables show percentages of each type nursing program reporting that their faculty have moderate or great need to learn about microcomputers (Table 1), moderate or great interest (Table 2), no experience (Table 3), and the administrator has moderate or great expectations for faculty relative to microcomputer software (Table 4). Not all of the 257 schools that responded answered every item.

FACULTY INTEREST

The nurse administrative heads reported that faculty have a high level of interest in computer technology (see Table 2). The highest level of interest was in utilizing software (91 percent), selecting software for purchase (84 percent), and evaluating software (82 percent). While developing software was of interest to fewer schools, 73 percent of the schools' faculties have moderate to great interest.

TABLE 2*

Schools Reporting that Faculty Have
Moderate or Great Interest in Microcomputer Software

		Bacc.	AD	AD/Bacc.	TOTAL
Developing Software	N	62	108	17	187
	(%)	(74%)	(71%)	(81%)	(73%)
Utilizing Software	N	76	137	20	233
	(%)	(90%)	(90%)	(95%)	(91%)
Selecting Software for Purchase	N	69	128	18	215
	(%)	(82%)	(84%)	(86%)	(84%)
Evaluating Software	N	66	126	19	211
	(%)	(79%)	(83%)	(90%)	(82%)

FACULTY EXPERIENCE WITH SOFTWARE

The schools reported that the vast majority of faculty have had no experience with microcomputer software. At 78 percent of the schools, faculty had no experience in developing software; only two schools reported great experience. As expected, faculty had somewhat more experience in using software, although only six schools reported great experience. Over 70 percent had no experience in selecting software for purchase or evaluating software (see Table 3).

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*See footnote, page 63.

TABLE 3*

Schools Reporting that Faculty Have
No Experience with Microcomputer Software

		Bacc.	AD	AD/Bacc.	TOTAL
Developing Software	N	55	132	13	200
	(%)	(65%)	(87%)	(62%)	(78%)
Utilizing Software	N	38	106	12	156
	(%)	(45%)	(70%)	(57%)	(61%)
Selecting Software for Purchase	N	52	122	14	188
	(%)	(62%)	(80%)	(67%)	(73%)
Evaluating Software	N	52	120	13	185
	(%)	(62%)	(79%)	(62%)	(72%)

FACULTY EXPECTATIONS

Almost a third of the nurse administrators expected their faculty to develop software in the coming year. And, more than half expected that faculty will help select software for purchase, will use it, and will evaluate it (see Table 4).

TABLE 4*

Schools Reporting
Great or Moderate Expectations for Faculty
Relative to Microcomputer Software

		Bacc.	AD	AD/Bacc.	TOTAL
Developing Software	N	33	37	10	80
	(%)	(39%)	(24%)	(48%)	(31%)
Utilizing Software	N	161	80	15	156
	(%)	(73%)	(53%)	(71%)	(61%)
Selecting Software for Purchase	N	55	77	14	146
	(%)	(65%)	(51%)	(67%)	(57%)
Evaluating Software	N	52	77	14	142
	(%)	(62%)	(50%)	(67%)	(55%)

* See footnote, page 63.

INTEREST IN REGIONAL ACTIVITIES

Almost without exception, the deans and directors said their school is interested in participating in a regional project to help faculty learn to use computer technology as an instructional tool. They wanted their faculty to establish networks with others who have similar microcomputer interests, and believed their faculty would benefit from receiving periodic written reports about microcomputer activities within the region. They were also sure faculty would be interested in attending workshops conducted by the project.

Strong support for a proposed project was also expressed by directors of continuing education, who were contacted through a separate questionnaire. Of the 36 CE directors who were contacted, 22 responded; only eight reported they had offered educational programs for faculty in the use of microcomputers for teaching.

Note: Based on these findings of need and interest, plans were developed for a regional project to provide a continuing education program designed to strengthen the ability of nurse faculty in basic collegiate programs in using computer technology as an instructional tool. At the time of this writing (spring, 1984), the proposal is under review by an outside agency. (AFS).